

Market  
Analysis  
Program  
(MAP)

Industry Sector  
 Markets  
 1991-1996

Discrete  
 Manufacturing  
 Sector

Forecast Update

**INPUT®**

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J A N U A R Y      1 9 9 2

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# INDUSTRY SECTOR MARKETS 1991-1996

## DISCRETE MANUFACTURING SECTOR

### FORECAST UPDATE



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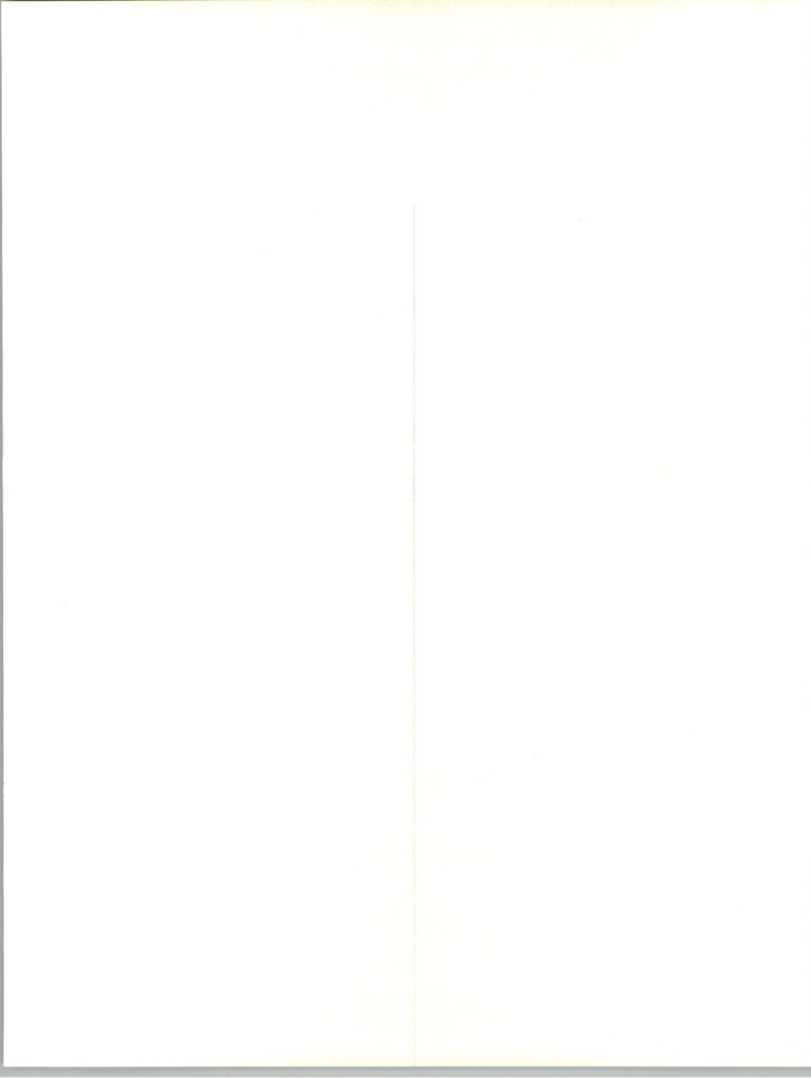
**Market Analysis Program (MAP)**

***Industry Sector Markets, 1991-1996***  
***Discrete Manufacturing Sector***

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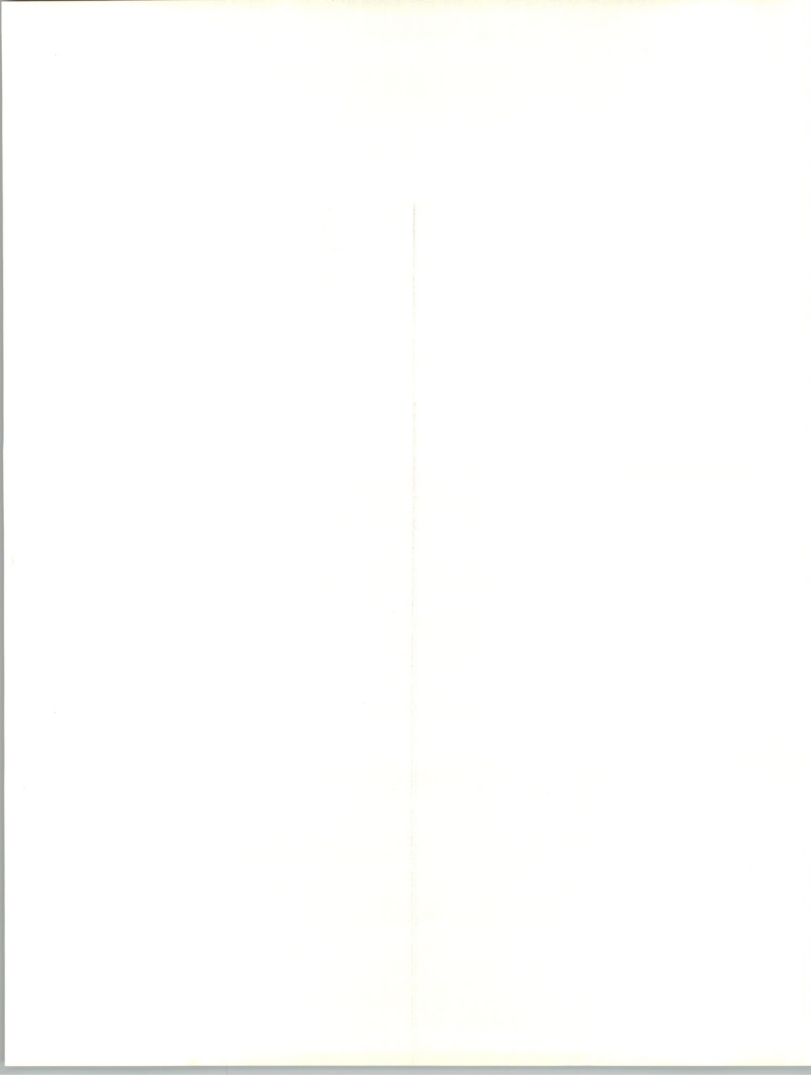
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# Table of Contents

<b>I</b>	<b>Purpose and Organization</b>	<b>I-1</b>
<b>II</b>	<b>Trends, Events, and Issues</b>	<b>II-1</b>
	A. Environment and Market Changes	II-1
	B. Information Technology Requirements	II-4
	C. Current Discrete Manufacturing Events	II-7
<b>III</b>	<b>Information Services Market Forecast</b>	<b>III-1</b>
	A. Total Market Forecast, 1990-1996	III-1
	B. Forecast by Delivery Mode	III-3
	1. Processing Services	III-3
	2. Turnkey Systems	III-4
	3. Applications Software Products	III-4
	4. Systems Operations	III-5
	5. Systems Integration	III-5
	6. Professional Services	III-6
	7. Network Services	III-7
<b>IV</b>	<b>Competitive Environment</b>	<b>IV-1</b>
	A. Recent Information Services Events	IV-1
	B. Vendor Profiles	IV-2
	1. Andersen Consulting	IV-3
	a. Company Strategy	IV-3
	b. Company Background	IV-3
	c. Products and Services	IV-4





## Table of Contents (Continued)

### IV

2. American Software, Inc.	IV-4
a. Company Strategy	IV-4
b. Company Background	IV-4
c. Products and Services	IV-4
3. BT Tymnet, Inc.	IV-5
a. Company Strategy	IV-5
b. Company Background	IV-5
c. Products and Services	IV-5
4. Computer Task Group, Inc.	IV-6
a. Company Strategy	IV-6
b. Company Background	IV-6
c. Products and Services	IV-7
5. CACI International, Inc.	IV-7
a. Company Strategy	IV-7
b. Company Background	IV-7
c. Products and Services	IV-7
6. Dun & Bradstreet Software Services, Inc.	IV-8
a. Company Strategy	IV-8
b. Company Background	IV-8
c. Products and Services	IV-8
7. Factorial Systems, Inc.	IV-9
a. Company Strategy	IV-9
b. Company Background	IV-9
c. Products and Services	IV-10
8. Sterling Software, Inc., - EDI Group	IV-10
a. Company Strategy	IV-10
b. Company Background	IV-10
c. Products and Services	IV-11
9. Symix Systems, Inc.	IV-11
a. Company Strategy	IV-11
b. Company Background	IV-12
c. Products and Services	IV-12

### Appendixes

A. Definitions	A-1
B. Forecast Data Base	B-1



## Exhibits

II	<ul style="list-style-type: none"><li>-1 Key Business Issues in the Discrete Manufacturing Industry II-4</li><li>-2 Key Technology Trends Identified by Vendors and Users in Discrete Manufacturing II-6</li></ul>
III	<ul style="list-style-type: none"><li>-1 Discrete Manufacturing Sector—User Expenditure Forecast, 1990-1996 III-2</li><li>-2 Discrete Manufacturing Sector—User Expenditure Forecast by Delivery Mode, 1991-1996 III-3</li></ul>
Appendix	<ul style="list-style-type: none"><li>B</li><li>-1 Discrete Manufacturing Sector—User Expenditure Forecast by Delivery Mode, 1990-1996 B-2</li><li>-2 Discrete Manufacturing Sector—1991 MAP Data Base Reconciliation B-3</li></ul>









# I

## Purpose and Organization









## Purpose and Organization

The purpose of this Forecast Update is to provide the 1991 INPUT forecasts for the discrete manufacturing industry sector and a discussion of recent market issues and competitive factors that are influencing the use of information services in this industry. In the 1990 report, a more comprehensive analysis of the components of the discrete manufacturing sector was presented and should be used as a reference if necessary.

The discrete manufacturing industry is composed of establishments contained in the following SIC groups:

SIC Group	Description
23xx	Apparel and other finished products
25xx	Furniture and fixtures
27xx	Printing, publishing, and allied industries
31xx	Leather and leather products
34xx	Fabricated metal products except machinery and transportation equipment
36xx	Electronic and other electrical equipment and components except computer equipment
35xx	Industrial and commercial machinery and computer equipment
37xx	Transportation equipment
38xx	Instruments; photo, medical, optical goods, watches and clocks
39xx	Miscellaneous manufacturing including toys, games, jewelry and sporting goods

This chapter of the report describes its purpose and organization. The other chapters of the report are organized as follows:

- Chapter II, Trends, Events, and Issues, describes the current discrete manufacturing industry and factors that can have an impact on the use of information services.



- Chapter III, Information Services Market, presents information services expenditures by delivery mode for the discrete manufacturing market.
- Chapter IV, Competitive Environment, provides a review of recent competitive events and vendor profiles.
- Appendix B, Forecast Data Base, is a detailed forecast by delivery mode for the discrete manufacturing industry. It contains a reconciliation to the previous year's forecast.

Related to this discrete manufacturing sector report are three additional sector reports:

- Process Manufacturing
- Business Services
- Miscellaneous Industries

A collection of all 15 INPUT market sector or industry reports and 7 cross-industry reports constitute INPUT's 1991 Market Analysis Program. Together, they provide a complete overview of the U.S. information services industry.





## II

### Trends, Events, and Issues

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111

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## Trends, Events, and Issues

### A

#### Environment and Market Changes

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By early December 1991, it was evident that discrete manufacturing had not shown any real recovery from the recession during the year.

- Domestic automotive manufacturing showed no signs of recovery.
- October factory orders had still not returned to the level of July 1981, according to the Commerce Department.
- The National Association of Manufacturers stated that the low level of the increase in all manufacturing announced for October showed little more than continuing sluggishness.

The November monthly survey of 300 or more purchasing managers by the National Association of Purchasing Managers indicated that their index of purchasing activity had dropped to 50.1%.

- A rating below 50% would have been a sign of contraction; the November reading was not positive enough to signal even a slight recovery.
- The level of the November index was the lowest figure since May. In the months between May and November, the manufacturing economy had been expanding.
- The data from the purchasing managers, which is gathered from a broad range of industrial companies—including all areas of discrete manufacturing—indicates that manufacturing activity slowed substantially during the last few months.

In discrete manufacturing, as in many other industries, there is a wide disparity in performance among different sectors.





- Electronic equipment orders rose in the third quarter, and orders for aircraft and defense items were higher on the average than in the previous period.
- Toy production has been another positive sector of discrete manufacturing.
- However, orders for industrial machinery and equipment fell 3.3% in October.
- Manufacture and sales of automobiles remained low throughout 1991.
- Apparel manufacturing also suffered from poor retail sales through most of 1991.

Despite the continuing impact of the recession on orders for manufactured goods, there were efforts to raise the price levels of a number of manufactured goods in the third quarter of 1991. This was an attempt to offset losses and improve the look of balance sheets as well as to finance improvements in manufacturing functions.

Many discrete manufacturers—including G.M., Ford, Deere & Co., and Intel—have initiated quality improvement programs.

- Japanese firms have shown that quality in manufacturing can be a means of creating greater efficiency and lowering costs.
- Japanese firms have also shown that quality improvements are associated with faster development and production changes. This makes it possible to introduce new or changed products more rapidly.

In order to achieve improvements in quality, manufacturers have learned to examine workers and the production process.

- The morale and productivity of workers has been improved by making jobs more meaningful and eliminating levels of management (empowering workers).
- Steps to improve the production process include the introduction or expansion of robotics, utilization of just-in-time inventory management, and utilization of new applications software that can make manufacturing more flexible.

In addition to the use of new applications software to obtain improvements in quality, there have been ongoing efforts to upgrade major application systems in manufacturing.



- Improvements in manufacturing resource planning (MRPII), master scheduling, accounting, and other functions that help to support MRPII have been successful to a large extent in improving discrete manufacturing. Over 90% of large firms now use MRPII applications.
- CAD/CAM software products that produce cost savings and improvements in product design and documentation have been implemented on new workstation products that enable CAD/CAM to be distributed further within manufacturing and increase effectiveness.
- The use of new and upgraded software products to expand the use of network applications such as EDI, which can link manufacturers with their suppliers and customers, enhanced the possibility of using just-in-time inventory techniques as well as reduce costs.

Attempts to improve integration of functions in manufacturing through CIM and other software products have also met with success, although further changes in manufacturing functions may be needed to accomplish integration in many companies.

Questions are being raised about the benefits that have been achieved by manufacturers through investments in automation. An article in the Fall 1991 issue of the Sloan Management Review stated that research on investments in CIM and other automation showed that there was no guarantee that benefits would justify the investments.

- Management techniques such as just-in-time may not be appropriate for some companies even if these techniques work in others.
- A company's automation approach may have to be analyzed and tailored to meet particular situations and markets.

Two research associates of the National Bureau of Economic Research have also stated that the aggressive investment in computerization of manufacturing in recent years has not achieved the payoffs expected.

Discrete manufacturers report that these types of questions and reflections lead them to become interested in information services vendors who can discuss problems and illustrate ideas with demonstrations and presentations or who are engaged in research on manufacturing functions.

Discrete manufacturers are also showing increased interest in research studies and new types of joint efforts with universities that can result in real changes in companies.

Key business issues identified by respondents from the discrete manufacturing industry are shown in Exhibit II-1:



## EXHIBIT II-1

**Key Business Issues in the  
Discrete Manufacturing Industry**

- Slow sales as the result of the recession
- Foreign competition from higher quality and/or lower cost firms
- Need to improve quality
- Need to reduce costs
- Dealing with mergers and consolidation
- Need for basic restructuring of business
- Desire to use information systems more effectively

Note: List is in order of importance to respondents.

**B****Information Technology Requirements**

The discrete manufacturing industry is composed of approximately 260,000 firms that produce manufactured goods singly or one at a time, rather than continuously or in a batch process as in process manufacturing.

The major computing application systems in use in discrete manufacturing can be reviewed or analyzed in terms of a model of the functions of the industry as outlined below:

- Business operations and planning, including accounting, financial, planning, marketing, sales and purchasing
- Engineering and design, including CAD/CAM, plant simulation, documentation, and design engineering
- Factory floor, including machine control, area control, and plant control



- Other functions such as plant maintenance, EDI, material warehousing and handling and, most importantly, the integration of other functions

The major computing application systems in use in the first area listed above include order entry and processing, sales forecasting, capacity planning, master production scheduling, bill of materials processing, MRP, MRPII, inventory control, product and manufacturing costing, and purchasing.

- Many of these application systems were initiated by processing services and then offered as software products for mainframes and minis.
- Since interaction with vendors and ongoing support have been important factors in the use of application systems, turnkey vendors such as The Ask Companies, and systems integrators such as Andersen Consulting have become important in the delivery of services.

The second area, engineering and design application systems, include CAD and CAE.

- These systems were originally developed by aerospace companies and software vendors as mainframe and mini software products. Now, CAD and CAE are chiefly available on turnkey systems and as software products marketed for workstations/PCs.
- Computer manufacturers have become increasingly important in this market through ownership of software products. Ownership enables manufacturers to promote the sale of computer hardware.
- Some of the earlier turnkey vendors are adding features that will aid in prototype evaluation and design analysis.

Factory floor applications include computer-aided manufacturing, plant monitoring, shop floor control, numerical control machines, supervisory control, and robotics.

- In addition to the CAM systems supplied with CAD, there are many turnkey systems and independent software vendors that address computer-aided manufacturing, shop floor control, and other manufacturing applications. Some of these vendors have specialized systems that are oriented to particular manufacturing areas such as apparel or electrical machinery.
- Many turnkey and independent software vendors—such as Adra Systems, Computervision, and CNC Software—also address individual sets of needs in numerical control, robotics, and other factory floor applications.





Other manufacturing application systems include computer-aided manufacturing maintenance, network applications such as EDI, material handling and warehousing, and systems that integrate functions such as CIM.

- Service is provided in each of the application systems areas by information services vendors specializing in particular application systems such as Sterling Software's EDI software products and network applications.
- Systems that integrate functions include software products that allow devices and groups to communicate through the use of MAP, TOP, or the OSI model; software products that integrate sets of applications, as SAP does; or products that attempt to integrate an entire manufacturing environment (computer-integrated manufacturing or CIM), as Cimline does.

A fully integrated manufacturing environment that allows a data base to be shared among users in business, factory floor, and engineering areas has proved difficult to accomplish. The concept is being researched by information services firms as well as by manufacturers and university research groups.

The key technology trends mentioned by vendors and users involved in the discrete manufacturing market are listed in Exhibit II-2.

EXHIBIT II-2

**Key Technology Trends Identified by  
Vendors and Users in Discrete Manufacturing**

- Greater use of integrated sets of products and services
- Impact of mergers, reorganization, downsizing on information systems
- More sophisticated data management to integrate functions in manufacturing
- Easier means of modifying software products to support restructuring of manufacturing functions
- Use of outsourcing to address complexity and costliness of information systems
- Ability to use and process images as well as sets of data



The discrete manufacturing industry needs many products and services from information services vendors as well as assistance in coping with the business issues and technological trends that were mentioned. Vendors have to consider what strategies and tactics should be followed in addressing the market.

- Some vendors are finding that they have placed themselves in a position where prospects and clients are demanding more support than products and services warrant.
- Other vendors have tried to carefully define areas of interest in order to limit the demands of customers for service. Users report that they want a closer relationship—perhaps even a sole or chief source of support with a vendor. There is a danger that vendors with limited resources might miss opportunities or find that they were bypassed for products they could have supplied.

Leading vendors in the discrete manufacturing environment—such as Andersen Consulting, IBM, EDS, CSC, and DEC—tend to be vendors that are willing to become highly involved with their clients and meet a number of requirements.

## C

### Current Discrete Manufacturing Events

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Major business schools at universities with engineering departments have initiated programs with leading manufacturing companies to develop graduates who can make improvements in manufacturing processes.

- Boeing, Eastman Kodak, and nine other companies have helped to finance this type of effort at the Massachusetts Institute of Technology. The program has already resulted in improvements in processes, although its main thrust has been to prepare better trained managers.
- This type of program—which has also been implemented at Penn State, Northwestern, Cornell, and Purdue—has resulted in increased research in manufacturing by faculty members at the institutions involved.

A strategic plan for U.S. industry was developed by 15 executives from leading companies at Lehigh University last summer. The conference focused on making manufacturing more flexible and able to implement rapid changes and faster production through massive new network capabilities, and factories that could be rapidly reconfigured through the aid of standardized machines, processes, and software products.

Network improvements are being utilized throughout manufacturing to improve services.



- Whirlpool has recently installed a system that uses imaging, wide-area networking, and an expert system to help service agents gain information from product and service manuals, diagnose customer problems, and recommend solutions.
- Some manufacturers have implemented on-line data bases to help customers obtain information about products that customers are considering or ordering.

Caterpillar has emphasized advanced communications in order to improve engineering as well as marketing and service. Caterpillar is able to have engineers in different locations work on the same image of a design or plan through Caterpillar's satellite network.

In addition to developments in the use of networks, vendors report that one of the areas of greatest interest to users is the means of integrating more discrete manufacturing activities. Vendors—including IBM, DEC, SAP, Andersen, ASK, and Dun & Bradstreet Software—are all responding to this challenge.





# Information Services Market Forecast









## Information Services Market Forecast

### A

#### Total Market Forecast, 1990-1996

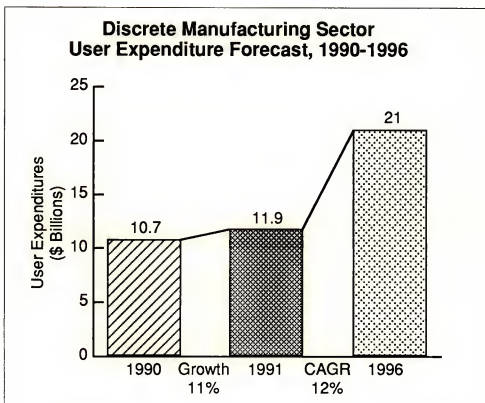
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As a result of the recession and global competition, expenditures for information services in the U.S. discrete manufacturing industry grew at a slower rate between 1990 and 1991 than they did in the previous year. The growth rate will increase during the next five years as shown in Exhibit III-1, although growth in some service modes will remain low.

- Expenditures will increase at a rate of 11%, from \$10.7 billion in 1990 to \$11.9 billion in 1991.
- The compounded annual growth rate (CAGR) will increase to 12% during the next five years, and user expenditures will grow from \$11.9 billion in 1991 to \$21 billion in 1996.



EXHIBIT III-1



As a result of the recession and increased global competition, the falling rate of orders for manufactured goods produced growth that was three percent below that previously forecast for 1990 and three percent below the rate forecast for growth between 1991 and 1996.

Although the overall growth rates for expenditures on information services in discrete manufacturing are down, a number of opportunities are available to vendors in this industry.

- Discrete manufacturing is one of the largest markets for information services.
- The structural and functional changes that are anticipated in discrete manufacturing will require new software products, turnkey systems, consulting, and network services.
- Systems integrators and professional services vendors will be needed to help implement new solutions. An increasing number of manufacturers will be evaluating outsourcing as a means of meeting challenges in technology.

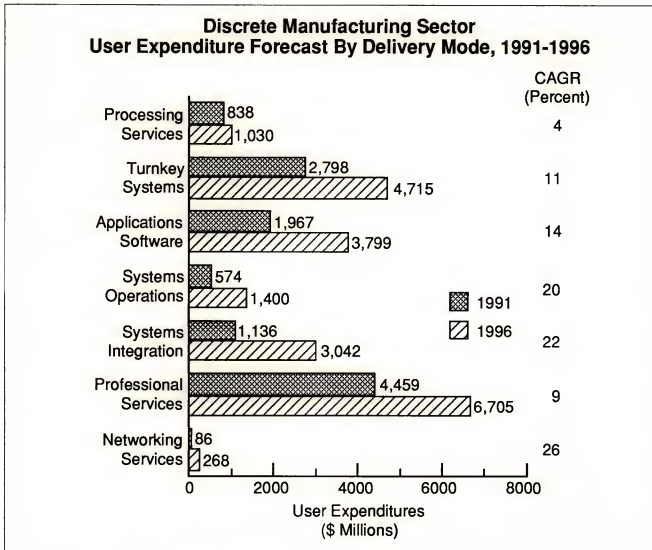


## B

## Forecast by Delivery Mode

Exhibit III-2 provides the 1991-1996 forecast for the discrete manufacturing sector by delivery mode.

EXHIBIT III-2



## 1. Processing Services

Processing services had the lowest growth rate for information services in discrete manufacturing in 1991 and are forecast to have the lowest rate between 1991 and 1996. At an annual rate of four percent per year, user expenditures for processing services grew from \$795 million in 1990 to \$838 million in 1991 and will reach \$1,038 million in 1996.



The low rate of growth reflects the fact that a number of discrete manufacturers, particularly smaller ones, are selecting workstation/PC solutions rather than processing services alternatives for accounting, inventory, and other functions.

Processing services will continue to be used for periodic jobs that require large-scale resources and to test major software product decisions before action is taken.

## **2. Turnkey Systems**

User expenditures for turnkey systems grew at a healthy rate of 14% between 1990 and 1991, rising from \$2.46 billion to \$2.80 billion in 1991. This was the highest growth rate for the use of turnkey systems among all industries in 1991.

- Expenditures will grow at a lower CAGR of 11% between 1991 and 1996, reaching \$4.7 billion in expenditures in 1996. Growth in five other industries will be at or above this rate.
- Expenditures for turnkey systems will remain higher in discrete manufacturing than in all other industries throughout the planning period.

In recent years, expenditures for turnkey systems have been stimulated by the delivery of CAD/CAM and production management systems through this service mode. Small and mid-sized discrete manufacturers have also become interested in the solutions and support offered by turnkey vendors.

- CAD/CAM software products are now being sold on an off-the-shelf basis with workstations and other computers by hardware manufacturers. This will cause a drop in the growth rate of turnkey system expenditures.
- Some discrete manufacturers that were formerly interested in turnkey solutions because of the support level provided may now contract for systems integration or systems operations projects. Systems integration or operations can provide even more support.
- Some discrete manufacturers are also turning to professional services vendors for consulting aid before considering turnkey or other types of information services vendors. This change is causing an increased growth rate for the use of professional services consulting as well as a possible drop in the growth rate for turnkey systems.

## **3. Applications Software Products**

Expenditures grew at a rate of 12% between 1990 and 1991 for applications software products, from \$1.8 billion to \$2.0 billion. The CAGR will increase to 14% between 1991 and 1996, when 1996 expenditures are estimated to be \$3.8 billion.





- Expenditures for PC/workstation applications software products will grow 24% per year—much higher than the market average.
- Between 1991 and 1996, the growth rates for mainframe and mini application software products will be 6% and 10% respectively.
- Forecast expenditures will be the highest, at \$1.7 billion, for minicomputer application software products in 1996. Workstation/PC product expenditures will be close behind, at \$1.6 billion. Expenditures for mainframe application software products will be about one-third as high as those for workstation/PC products in 1996.

The 12% growth rate for applications software products in 1990 remained the same as in the previous forecast—despite the impact of the recession—and the present CAGR forecast for 1991 to 1996 (14%) is one percent above the previous forecast.

- The increase in growth rate is partially due to the relative increase in off-the-shelf CAD/CAM software products purchases versus CAD/CAM turnkey systems solutions, as discussed in the prior section regarding turnkey systems.
- The increased forecast for the use of applications software products in the discrete manufacturing industry, particularly those for workstations/PCs, is also due to increasing interest in client/server applications that can allow functions to be interconnected.

#### 4. Systems Operations

Systems operations is one of the faster growing delivery modes in discrete manufacturing, with a growth rate of 18% from 1990 to 1991 that reflects an increase in expenditures from \$0.5 billion in 1990 to \$0.6 billion in 1991.

- Growth will continue at a CAGR of 20% between 1991 and 1996, when expenditures are forecast to reach \$1.4 billion.
- Growth rates were lowered from previous forecasts because of the impact of the recession and overall questions about the use of information systems in manufacturing. These factors are delaying action on outsourcing, although the forecast for use of systems operations remains high.

#### 5. Systems Integration

Expenditures for systems integration services grew at a rate of 20% between 1990 and 1991 and increased from \$0.9 billion in 1990 to \$1.1 billion in 1991. Expenditures will grow at a higher rate—at a 22% CAGR—between 1991 and 1996 and reach \$3 billion in 1996.



Due to the impact of the recession on funding—particularly for large projects—as well as interest in downsized solutions, expenditures are below previous forecasts.

- Discrete manufacturing will remain the leading market for systems integration services outside of the federal government and will be a major target for most of the large systems integration firms such as Andersen Consulting, EDS, IBM, and CSC.
- The systems integration market is growing faster in discrete manufacturing than in all but the business services sector.

The rapid growth of systems integration and systems operations user expenditures indicates the high level of interest in information services that provide closer support and interaction.

## **6. Professional Services**

The rate of growth of expenditures for professional services between 1990 and 1991 shrank to seven percent; four percent below the rate previously forecast. Expenditures grew from \$4.1 billion to \$4.5 billion during that period.

- Between 1991 and 1996, user expenditures for professional services will grow at a CAGR of nine percent, which is also four percent below previous forecasts.
- Expenditures for professional services will reach \$6.7 billion in 1996.

Despite the falling growth rates, the professional services delivery mode will remain the largest one serving the discrete manufacturing market. Many of the vendors providing professional services to this industry, particularly the larger firms, offer other information services that can stimulate the use of professional services.

- Most of the larger professional services vendors in discrete manufacturing—such as IBM, DEC, EDS and CTG—also have systems integration business in this industry.
- Several software product vendors supporting discrete manufacturing also have professional services business in this industry, including American Software, Pansophic (now owned by Computer Associates) and Oracle.

Consulting services is the fastest growing submode of professional services to discrete manufacturing. This reflects the interest of users in this industry in research and investigation that will lead to meaningful, improved quality and performance solutions.



- Large professional services and systems integration vendors, including the Big 6 firms, are profiting from this work.
- Booz Allen & Hamilton and McKinsey & Co. are also profiting from professional services consulting work.

## 7. Network Services

Network services is the fastest growing delivery mode in the discrete manufacturing industry, with a growth rate of 25% in 1991 and a projected CAGR of 26% between 1991 and 1996.

- Expenditures increased from \$69 million in 1990 to \$86 million in 1991 and will grow to \$268 million in 1996.
- The growth of network services is driven by its fastest growing submode—network applications. It will have a CAGR of 29% between 1991 and 1996.

The mushrooming use of EDI and electronic commerce to support ordering and payment to suppliers and from some customers is needed to support just-in-time and other faster and/or more flexible means of linking work together.

The use of on-line data bases (a submode of electronic information services) with technical, economic and financial information is also growing at a fast rate in discrete manufacturing.











## Competitive Environment





## IV

## Competitive Environment

## A

### Recent Information Services Events

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There have been a number of new product/service announcements, alliances, mergers and acquisitions by information services vendors serving discrete manufacturing during the past year. Events that characterize the dynamic nature of this vertical market are included in this section.

Oracle has announced a manufacturing system that will compete with existing MRP systems. It has been tested at four customer sites.

- Oracle will support the product with consulting services and will make arrangements with Big 6 firms and other integrators and VARs to represent the product.
- Advantages of the product include its availability on multiple hardware platforms and use of relational data bases, CASE tools, and 4GL and graphics capabilities.

EDS acquired McDonnell Douglas Systems Integration Co. The acquisition included MDSI's respected Unigraphics CAD/CAM capability and research facilities in solid modeling.

- This move supports EDS' plan to build an all-encompassing manufacturing services capability.
- The acquisition also gave EDS a number of significant CAD/CAM users at Pratt & Whitney, GTE, and Bell Operating Companies, as well as at General Motors.

During this past fall, IBM began to ship the CIM/400 software product that enables users of the AS/400, RS/6000 and PS/2 to share information in their design, business and plant floor systems.



Hewlett-Packard has released software tools that enable data to be exchanged between CAD, MRP and production applications systems using its computers and version of UNIX. HP also plans to interface to a number of computers from other vendors.

Developments in machine vision from Adept Systems, Cognex and other vendors will allow robotics to be applied to more complex and delicate tasks.

## B

### Vendor Profiles

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Profiles of several different types of information services vendors active in the discrete manufacturing industry are presented in this section. The strategies, backgrounds, and products and services of these vendors are reviewed to illustrate the range of competition in the industry.

Some vendors active in discrete manufacturing concentrate on a limited set of capabilities in one or a few functional or service mode areas.

- GEIS provides EDI and VAN network applications services to discrete manufacturers.
- Gerber Scientific provides CAD/CAM turnkey systems to companies across a range of discrete manufacturing areas.

Other vendors are focusing on information services products and services that can meet a wider range of information processing requirements.

- Andersen Consulting, Coopers & Lybrand and other Big 6 firms are attempting to meet a wide range of needs of many types of discrete manufacturers.
- Through the acquisition of MDSI, EDS announced that it had strengthened its ability to offer a wide range of services.

Larger vendors serving the discrete manufacturing market also serve a number of other markets. There are many smaller vendors that only serve manufacturing or the discrete manufacturing market such as Symix and Factorial Systems.

In addition to the companies profiled, many other information services vendors serve the discrete manufacturing market, including IBM, NCR, DEC, and GEIS.



Companies profiled include:

- Andersen Consulting
- American Software
- BT Tymnet
- Computer Task Group
- CACI
- Dun & Bradstreet Software
- Factorial Systems
- Sterling Software, Inc., - EDI Group
- Symix

Additional information about these companies or other companies active in discrete manufacturing can be found in INPUT's Vendor Analysis Program (VAP).

**1. Andersen Consulting, Arthur Andersen & Co., 69 West Washington Street, Chicago, IL 60602, (312) 507-2900**

**a. Company Strategy**

Andersen utilizes its reputation in manufacturing and demonstrations of working solutions to manufacturing and distribution problems as a means of appealing to and closing business with prospects who are solution oriented. Andersen focuses more attention on manufacturing than on other markets, but has extended its capabilities to retail and wholesale distribution, banking, utilities and other markets.

Andersen emphasizes its knowledge of industries and applications, particularly in manufacturing and distribution, to make presentations and conduct consulting studies that can lead to large SI and professional services contracts. By means of studying the performance and problems of companies in its areas of interest, Andersen has been able to suggest opportunities to gain revenues and improve earnings at companies that it contacts. The firm uses acquisitions and alliances to gain additional resources and knowledge that address its areas of interest.

**b. Company Background**

Andersen Consulting was set up by Arthur Andersen & Co. as a separate firm in 1988 to address its rapidly growing, large volume of information services business. Estimated worldwide revenues in 1990 for Andersen Consulting were \$2,120 million, 30% above the revenue for 1989. U.S. revenues increased by about 21% to \$1,230 million in 1990.





### **c. Products and Services**

Over half of Andersen Consulting's 1990 revenue was derived from systems integration and about 25% from professional services. Systems operations revenue increased to about 8% of total revenue in 1990, and revenue was also obtained from applications and systems software products and network services.

Areas of manufacturing expertise include CIM, CAD/CAM, MRP II, robotics, material handling, numerical control, bar code data collection, and change management control.

**2. American Software, Inc., 470 East Paces Ferry Rd., Atlanta, GA 30305, (404) 261-4381**

#### **a. Company Strategy**

American Software has developed an integrated line of standard applications software products for IBM mainframe and AS/400 platforms designed to run singly or in combination to meet unique customer requirements.

- These products have been supplemented to meet the needs of installation in particular industries, particularly manufacturing.
- American Software will perform professional services work to customize its software products to solve customer problems.

In addition to a set of manufacturing modules, American Software offers a full MRPII system for IBM mainframes and minis.

#### **b. Company Background**

American Software was founded in 1970. The company grew to around 750 full-time employees in 1990, and its calendar-year revenues for 1990 reached almost \$100 million. The company provides applications software products and professional services to manufacturing, distribution, utilities, banking and finance, health care, education, transportation and government clients.

### **c. Products and Services**

About 37% of American Software's revenues are from professional services and 13% from maintenance of software products, which could be included as part of professional services.



- As shown above, about half of the company's revenue is from professional services.
- American Software is one of the most successful software products vendors that provide professional services.

American's applications software products can be divided into two groups:

- Forecasting and inventory management software accounts for about 8% of revenue.
- Purchasing, materials control, and financial software accounts for about 38% of revenue.

Specific manufacturing modules include master scheduling, materials requirement planning, bill of material, capacity planning, production work status, shop floor control, and cost management and tracking.

**3. BT Tymnet, Inc. 2560 North First St., San Jose, CA 95131, (408) 922-0250**

#### **a. Company Strategy**

BT Tymnet is in business to be one of the world's largest providers of a wide range of shared, dedicated and hybrid network solutions. The company operates the TYMNET public packet data communications network and provides access to dial-up services, major on-line data bases, EDI services, card authorization/electronic data capture, and other services in support of its strategy.

BT Tymnet has penetrated manufacturing, distribution, warehousing and other industries where EDI business could grow.

#### **b. Company Background**

The TYMNET data network was initiated in 1969 to support remote processing services to timesharing clients. In 1977, it became an FCC-regulated specialized common carrier and was acquired by McDonnell Douglas in 1984. In 1989, it was acquired by British Telecom plc, along with a value-added service provider active in Japan. These acquisitions—together with Dialcom, acquired in 1986—were organized as BT Tymnet, a subsidiary of British Telecom, in 1989.

#### **c. Products and Services**

The TYMNET network consists of intelligent communications processors and network capabilities that allow clients to communicate between attended or unattended terminals, on their own or other computers, in a



variety of locations. A number of protocols, error correction, protocol conversion, data security and other services are provided by the network. Access to major on-line data bases is also provided through this network.

EDI\*Net is the principal EDI service of BT Tymnet, providing third-party, value-added communications services for automated exchange of business documents such as purchase orders, invoices, and bills of lading. There are over 1,000 clients from the transportation, distribution, manufacturing, and telecommunications industries. The aerospace industry is a significant user of EDI and other network services within the discrete manufacturing sector.

Credit card and electronic data capture are provided for all major credit cards as well as private-label programs.

Private and hybrid data networks are also provided to clients in a number of industries. Ford Motor Co. utilizes a hybrid system combining shared and dedicated equipment as well as VAN services from BY Tymnet.

#### **4. Computer Task Group, Inc., 800 Delaware Avenue, Buffalo, NY 14209, (716) 882-8000**

##### **a. Company Strategy**

CTG's strengths and experience are in delivering professional services to meet a range of problems from large, complex jobs to tasks requiring the knowledge of high-level technological skills. Capabilities have been developed to support systems integration and network development.

CTG markets its professional services to a number of industries, including discrete and process manufacturing, business services, banking and finance, insurance, and state and local government. CTG has considerable knowledge of the implementation of MRP and MRP II systems.

##### **b. Company Background**

Computer Task Group, founded in 1966, is one of the largest vendors of professional services that concentrates on markets other than the federal government. It provides systems integration services as well as professional services. Its U.S. revenues were \$232 million in 1990.

In 1989, IBM made an investment in CTG and has used CTG's systems engineers on work for IBM and its clients.



### **c. Products and Services**

Over 80% of 1990 revenue was from professional services, and the balance was made up of systems integration work and a small amount of systems operations work. CTG provides consultants experienced in industry problems as well as in technology, which is attractive to discrete manufacturers.

- CTG's staff can augment the staff of a client and become part of the project team, or it can manage and staff an entire project.
- CTG has experience in supporting large clients at a single site or at multiple sites, and on a domestic or worldwide basis.

### **5. CACI International, Inc.**

**1700 North Moore St., Arlington, VA 22209, (703) 841-7800**

#### **a. Company Strategy**

CACI utilizes its strengths in advanced information system development, engineering and logistics systems, and simulation systems and modeling to obtain federal government contracts.

In recent years, CACI has been using the experience it gained from government work to provide inventory and warehouse systems to wholesale, retail, manufacturing, and other commercial businesses.

#### **b. Company Background**

CACI was founded in 1962 to provide professional and marketing services, based on a high level of technology, to U.S. and international markets.

About 70% of CACI's business is with the federal government, including program management, policy decision support, and advanced systems support.

CACI also engages in marketing analysis and planning support services in the commercial sector.

#### **c. Products and Services**

CACI's services in wholesale and retail distribution and manufacturing include inventory and warehouse management and warehouse automation. In addition to consulting and software development, CACI provides implementation work on the robotics used for warehouse automation.





In the federal market, as described above, CACI provides professional and engineering services and simulation and modeling. CACI also markets SIMSCRIPT, a leading systems simulation and modeling software product.

Marketing support activities are provided on an international basis and include market research and demographic consulting.

**6. Dun & Bradstreet Software Services, Inc., 550 Cochituate Rd., Framingham, MA 01701, (508) 370-5000**

**a. Company Strategy**

The company develops, markets, and supports a wide range of industry and cross-industry software products on multiple vendor platforms.

- Applications software products are available for financial and accounting, human resources, administrative, purchasing, inventory, manufacturing, education, and health industry functions.
- The AMAPS systems support discrete and process manufacturing environments on multiple vendor platforms. A program to develop interfaces with the manufacturing software products of other vendors is available. About 45% of the company's revenue is derived from the manufacturing industries.

In addition to AMAPS systems, discrete manufacturers use Dun & Bradstreet software products for inventory control, human resources, accounting, financial reporting and other standalone applications. Dun & Bradstreet also provides professional services aid in planning, using, and customizing software products.

D&B's software products utilize a number of hardware platforms, including IBM, Unisys, DEC, HP and Bull mainframe and midrange equipment.

**b. Company Background**

This company is a subsidiary of the Dun & Bradstreet Corporation. It was formed in 1990 as a result of the merger of Management Science America (MSA), acquired in 1990, and McCormack & Dodge, which had been acquired in 1983. MSA was founded in 1963 and had over 24,500 product installations. McCormack & Dodge, founded in 1969, had over 10,000 product installations.

**c. Products and Services**

Dun & Bradstreet's software addresses a number of functions, as described in the following material:



- The Millennium Series supports human resource, accounting, and support functions, chiefly on IBM and compatible mainframes. Some products are also available for DEC VAX computers.
- The PLUS series offers accounting functions and a micro-to-mini link for IBM AS/400s and System /38s.
- Human resource products are available for IBM and compatible PCs.
- The BrightView Series, which allows the use of intelligent workstations and addresses accounting, inventory and budgeting functions, uses IBM mainframe and 9370 computers.
- The AMAPS manufacturing software products, which also can use intelligent workstations, are available for IBM mainframes and minis, and HP computers.
- Software products are also available for education, factory operations, and other functions.

**7. Factorial Systems, Inc., 6300 Bridgepoint Parkway, Austin, TX 78730, (512) 345-1192**

**a. Company Strategy**

Factorial Systems was founded to provide manufacturing control systems solutions. The capabilities it uses to achieve this objective include:

- The expertise and experience of its employees in implementing factory management and control solutions
- Research and development partnerships in the academic environment
- The ability to provide high-level consulting services in addition to software products
- A proven factory management and control software system acquired from Tandem that has been improved and upgraded to provide workflow, material services, and labor services capabilities

**b. Company Background**

The company was founded in 1985 to provide manufacturing control systems. It operates from one location, and employs less than 20 people. Approximately 80% of Factorial's revenue is derived from the U.S. and 20% from the U.K.



### **c. Products and Services**

The software system that Factorial originally acquired from Tandem has been generalized and is provided for workstations/PCs running under OS/2 as well as for Tandem computers running under Guardian and SQL.

The system, now called the Paperless Factory System, includes:

- A knowledge-based management and control system that provides on-line tracking, routing, data collection, resource management, quality control, configuration management, and interfaces to other systems and equipment
- A material control system that provides just-in-time and traditional methods of inventory replenishment as well as inventory management, control, accounting, and other functions
- A time and attendance and labor reporting system that operates on a standalone basis or integrated with the functions listed above

## **8. Sterling Software, Inc., - EDI Group, 4600 Lakehurst Court, P.O. Box 7160, Dublin, OH 43017, (614) 793-7000**

### **a. Company Strategy**

Sterling's EDI Group has developed and acquired a comprehensive set of EDI services and related software and services that have established the company as a major competitor and source of expertise in EDI.

As part of its strategy, the EDI Group focuses on maintaining a close relationship with clients and supplying their needs as their use of EDI expands. This strategy is supported with education and participation in the largest user group in the EDI market.

Markets that the EDI Group has penetrated include wholesale and retail distribution (grocery, hardware, and housewares) as well as pharmaceutical, medical/surgical distribution, and service merchandising.

### **b. Company Background**

The EDI Group was created in October 1990, and includes the ORDERNET Services Division, the EDI Labs Division, and an EDI International Division, headquartered in London. The REDINET Services Division of CDC was acquired in 1991 and was folded into the ORDERNET Division. Fiscal year 1990 revenues were over \$23 million, with 85% of revenues coming from the U.S.



### **c. Products and Services**

About 55% of the EDI Group's revenue comes from software products and 45% from network services. Software products and network services are offered through the ORDERNET division to over 2,700 customers in the pharmaceutical, grocery, hardware and housewares, retail, medical distribution, mass merchandising, warehousing, transportation, and automotive industries.

ORDERNET provides an on-line network to manage and control the flow of standardized business documents among over 2,000 trading partners.

Services to certain industries are provided through vendors active in those industries. ORDERNET services are made available to hospitals through GTE Health Systems. Services including a data base on drug use are made available to the medical industry through International Health Applications.

Internetwork traffic for the grocery industry is supported through BT Tymnet.

Electronic transmission of chargeback information between wholesalers and pharmaceutical manufacturers is provided in three formats established by several national druggists' associations.

Translation between established standards for EDI and other standards in use, and between a variety of record formats—as well as support of existing protocols on different hardware platforms—are provided with software from the EDI Group.

A data base service is also available to build on EDI documents, including purchase orders and invoices, that trading partners use during business.

Security services, education, and software maintenance are also offered in support of EDI products and services.

## **9. Symix Systems, Inc., 2400 Corporate Exchange Drive, Columbus, OH 43231, (614) 895-0738**

### **a. Company Strategy**

Symix has developed and is marketing a turnkey system that meets the needs of "make-to-order" manufacturers. The system, which is called Symix, is an integrated manufacturing control, accounting, and financial system.





Although Symix is sold primarily with IBM and Hewlett-Packard computers, it could be sold with a variety of other equipment.

- The system is written in a 4GL relational data base language and will run on 300 hardware platforms that use the UNIX operating system, including IBM, HP, DEC, NCR, and Sun equipment.
- The system can also be delivered in versions that will run with VMS and DOS and with LANs such as Novell and Ethernet.

#### **b. Company Background**

Symix Systems was founded in 1979 to develop and market manufacturing software for minicomputers. The company developed the Symix system in 1986 and began to market it in 1988. An IPO was offered in March 1991.

#### **c. Products and Services**

Other than being a VAR for IBM and HP, the company focuses on its Symix software product.

The modules of Symix perform the following functions:

- Inventory control and data collection
- Customer order entry
- Product configuration
- Purchasing
- Shop floor control and data collection
- Time and attendance data collection
- Advance manufacturing/MRP
- Engineering change notice
- Accounting and financial management, including payroll and fixed assets



## Appendixes

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## Definitions

No industry-specific terms have been used in this report.

See the separate volume, INPUT's *Definition of Terms*, for general definitions of industry structure and delivery modes used throughout INPUT reports.











## Forecast Data Base

A

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### Forecast Data Base

Exhibit B-1 presents the 1990-1996 forecast data base for the discrete manufacturing sector.



## EXHIBIT B-1

**Discrete Manufacturing Sector  
User Expenditure Forecast by Delivery Mode, 1990-1996  
(\$ Millions)**

Delivery Modes	1990 (\$M)	Growth 90-91 (%)	1991 (\$M)	1992 (\$M)	1993 (\$M)	1994 (\$M)	1995 ( M)	1996 (\$M)	CAGR 91-96 (%)
<b>Sector Total</b>	10,691	11	11,858	13,241	14,812	16,552	18,498	20,967	12
<i>Processing Services</i>	795	5	838	875	915	956	994	1,038	4
- Transaction Processing	795	5	838	875	915	956	994	1,038	4
<i>Turnkey Systems</i>	2,460	14	2,798	3,097	3,404	3,727	4,084	4,715	11
<i>Applications Software Products</i>	1,755	12	1,967	2,224	2,530	2,881	3,295	3,799	14
- Mainframe	372	3	383	410	442	467	492	524	6
- Minicomputer	935	12	1,046	1,158	1,268	1,389	1,522	1,685	10
- Workstation/PC	448	20	538	656	820	1,025	1,281	1,590	24
<i>Systems Operations</i>	486	18	574	688	828	989	1,175	1,400	20
<i>Systems Integration</i>	943	20	1,136	1,406	1,744	2,126	2,552	3,042	22
<i>Professional Services</i>	4,163	7	4,459	4,842	5,255	5,702	6,184	6,705	9
<i>Network Services</i>	69	25	86	109	136	171	214	268	26
- Electronic Info. Svcs.	35	23	43	52	63	76	93	114	22
- Network Applications	34	26	43	57	73	95	121	154	29



## B

## Data Base Reconciliation

Exhibit B-2 present the reconciliation of the 1990 and 1991 forecasts for the discrete manufacturing sector.

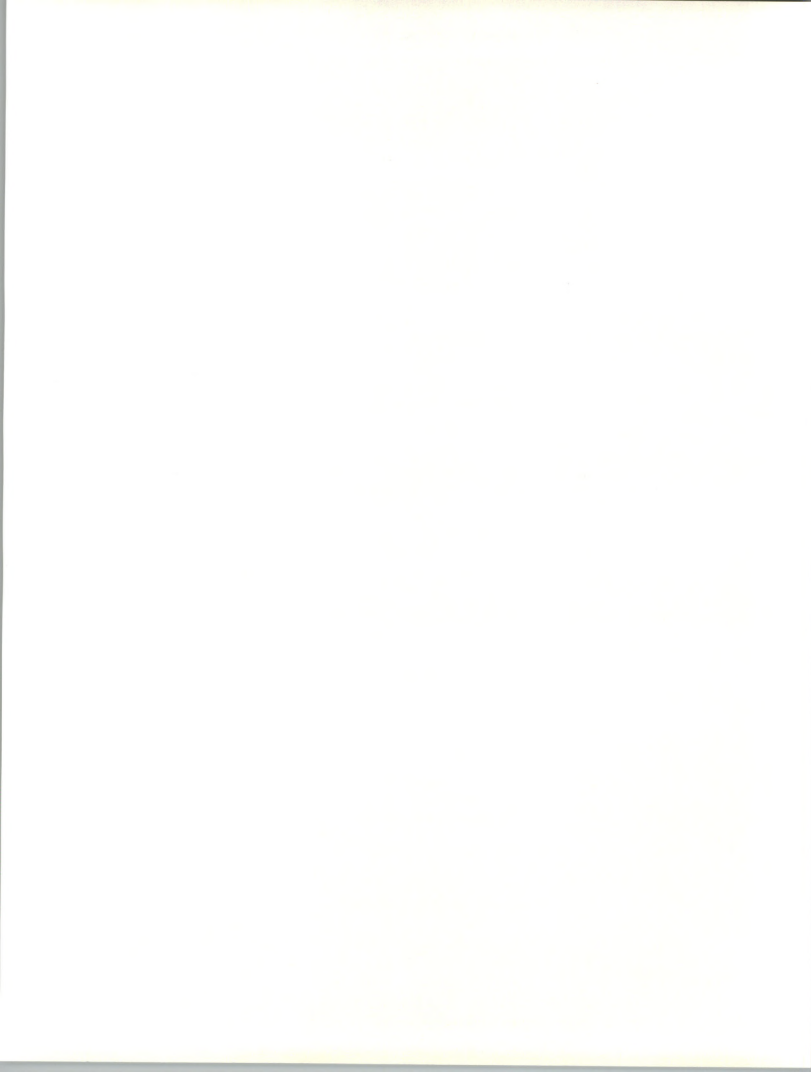
EXHIBIT B-2

**Discrete Manufacturing Sector  
1991 MAP Data Base Reconciliation  
(\$ Millions)**

Delivery Modes	1990 Market				1995 Market				90-95 CAGR per data 90 Rpt (%)	90-95 CAGR per data 91 Rpt (%)
	1990 Report (Fcst) (\$M)	1991 Report (Actual) (\$M)	Variance from 1990 Report		1990 Report (Fcst) (\$M)	1991 Report (Fcst) (\$M)	Variance from 1990 Report			
			(\$M)	(%)			(\$M)	(%)		
Total Discrete Manufacturing Sector	10,766	10,691	75	-1	20,594	18,498	-2,096	-10	14	12
Processing Services	795	795	0	—	1,064	994	-70	-7	6	4
- Transaction Processing	795	795	0	—	1,064	994	-70	-7	6	4
Turnkey Systems	2,460	2,460	0	—	4,084	4,084	0	—	11	11
Applications Software	1,828	1,755	-73	-4	3,412	3,295	-117	-3	13	14
Systems Operations	482	486	4	1	1,329	1,175	-154	-12	22	20
Systems Integration	977	943	-34	-3	2,933	2,552	-381	-13	25	22
Professional Services	4,163	4,163	0	—	7,572	6,184	-1,388	-18	13	9
Network Services	69	69	0	—	201	214	13	6	24	26

The actual expenditures for 1990 were only 1% below forecast, due to a shortfall of 4% in expenditures for systems integration. Both decreases were due to the impact of the recession in 1990.

The intensity and continuation of the recession was not fully anticipated in 1990, however. Forecasts developed in this year show reductions of 10% to 20% in the total sector and for expenditures in all service modes except turnkey systems and network services, as opposed to the previous 1995 forecast.



- Delays or cancellations of projects led to drops in forecasted expenditures for systems integration, systems operations, applications software products and professional services.
- The forecasted CAGRs for systems integration, systems operations, and applications software products show that these delivery modes are resuming growth. Although the first two are reduced, they still approach 20% over the 1991-1996 period.

The drop in the professional services forecast for 1995 to a CAGR of 8% versus 13% indicates more than the impact of the recession. Discrete manufacturing is turning from software development to systems integration and systems operations and software products for solutions.

The drop from 6% to 5% in the processing services forecast also reflects a decline in this mode. Midsized and small manufacturers are turning to PC/workstation-based solutions.

Forecasted network services expenditures are slightly increased, reflecting continued expansion of EDI and related services. Discrete manufacturing remains, however, a relatively modest user of network services, with 1991 expenditures estimated at only \$86 million.





# About INPUT

INPUT provides planning information, analysis, and recommendations for the information technology industries. Through market research, technology forecasting, and competitive analysis, INPUT supports client management in making informed decisions.

Subscription services, proprietary research/consulting, merger/acquisition assistance, and multiclient studies are provided to users and vendors of information systems and services. INPUT specializes in the software and services industry which includes software products, systems operations, processing services, network services, systems integration, professional services, turnkey systems, and customer services. Particular areas of expertise include CASE analysis, information systems planning, and outsourcing.

Many of INPUT's professional staff members have more than 20 years' experience in their areas of specialization. Most have held senior management positions in operations, marketing, or planning. This expertise enables INPUT to supply practical solutions to complex business problems.

Formed as a privately held corporation in 1974, INPUT has become a leading international research and consulting firm. Clients include more than 100 of the world's largest and most technically advanced companies.

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